PACKAGED PRODUCT COMPRISING FLEXIBLE, LIQUID-FILLED POUCHES

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Cross Reference to Related Applications

This application claims priority under 35 U.S.C. § 119(a) to European Application Serial No. 02078634.9, filed September 5, 2002 (Attorney Docket No. CM2694F).

Field of the Invention

The present invention relates to a packaged product comprising flexible, liquid-filled pouches, for example water-soluble liquid detergent pouches in unit dose form.

Background of the Invention

Flexible, liquid-filled pouches are known as a convenient form of packaging consumer products as well as agrochemical and industrial products. The liquid can be provided in pre-measured quantities intended for use as "unit doses". The flexible film enveloping the liquid product, which forms the wall of the pouch, may optionally be soluble in water. A particularly suitable water-soluble film for this purpose is made from polyvinyl alcohol, and, in this context, this invention is particularly suited to packaging unit doses of liquid detergent.

EP-A-0 347 219, published on 20th December 1989, discloses a package for liquid concentrates which comprises an outer container and an inner water-soluble envelope containing the concentrate. The outer container has a shock-absorbing base formed by joining the base-part to the main body-part with an S-shaped or corrugated strip.

The prior art does not address the problem that arises when a plurality of flexible, liquid-filled pouches are packed in random orientation in an outer container such as a box, carton or tub. The randomly oriented pouches lie in contact with one another and, if the outer container is subjected to a shock, the pouches are likely to tear, split or burst. The present invention provides a solution to such problems encountered with a packaged product comprising a plurality of flexible liquid-filled pouches and an outer container for containing the pouches.

Summary of the Invention

The present invention relates to an outer container which contains a plurality of flexible liquid-filled pouches whereby at least two or more of the flexible liquid-filled pouches are in mutual contact, and wherein the outer container further comprises means for avoiding or minimizing rupture of the flexible liquid-filled pouches when the outer container is subject to shock.

Detailed Description of the Invention

Flexible liquid-filled pouches according to the present invention are preferably formed by sealing the liquid product within a flexible film which forms the wall of the pouch. The flexible film may optionally be soluble in water, or alternatively the dispensing of the liquid product may be achieved by cutting or tearing open the flexible film wall.

By liquid-filled it is meant that the pouches contain at least some liquid. In almost all cases there will also be an air bubble within the sealed pouch. Furthermore, the invention is intended to cover embodiments in which both liquids and other product forms, such as granules, are packed either together within the same pouch or within adjacent pouches or adjacent sections of the same pouch.

A preferred water-soluble film is made from polymers, copolymers or derivatives thereof selected from polyvinyl alcohols, polyalkylene oxides, acrylic acid, cellulose, cellulose ethers, cellulose esters, polyvinyl acetates, polycarboxylic acids and salts, polyaminoacids or peptides, polyamides, copolymers of maleic/acrylic acids, polysaccharides including starch and gelatine, natural gums such as xanthum and carragum. More preferably, the polymer is selected from polyacrylates and water-soluble acrylate copolymers, methylcellulose, carboxymethylcellulose sodium, dextrin, ethylcellulose, hydroxyethyl cellulose, hydroxypropyl methylcellulose, maltodextrin, polymethacrylates, most preferably polyvinyl alcohols, polyvinyl alcohol copolymers and hydroxypropyl methyl cellulose (HPMC). Preferably, the level of a type polymer (e.g., commercial mixture) in the film material, for example PVA polymer, is at least 60% by weight of the film. The polymer can have any weight average molecular weight, preferably from about 1000 to 1,000,000, or more preferably from 10,000 to 300,000, or even more preferably from 15,000 to 200,000, or most preferably from 20,000 to 150,000. Mixtures or blends of polymers may be used.

Highly preferred is polyvinyl alcohol formed by extrusion, blow-extrusion, blow-molding or casting into a thin film. Such a film is preferably 10 to 200 micrometers thick, more preferably from 40 to 100 micrometers thick.

Most preferred material for making the flexible pouch is water-soluble polyvinyl alcohol, preferably wherein the polymer present in the film is from 60 to 98% hydrolysed, preferably 80% to 90%, to improve the dissolution of the material. An example of a particularly suitable water-soluble polyvinyl alcohol film is sold under the trade reference M8630 by Mono-Sol of Gary, Indiana, US. This particular film has a tensile strength of 281 kg/cm^2; modulus of 105 kg/cm^2; elongation of 465%; tear resistance of 41 kg/mm; and impact strength of 800g. It is commercially available in thicknesses of 38, 50 and 76 micrometers.

The water-soluble film herein may comprise other additive ingredients than the polymer or polymer material. For example, it may be beneficial to add plasticisers, for example glycerol, ethylene glycol, diethyleneglycol, propylene glycol, propane diol, sorbitol and mixtures thereof, additional water, disintegrating aids. It may be useful that the pouch or water-soluble film itself comprises a detergent additive to be delivered to the wash water, for example organic polymeric soil release agents, dispersants, dye transfer inhibitors. Optionally, the surface of the film of the pouch may be dusted with fine powder to reduce the coefficient of friction. Sodium aluminosilicate, silica, talc and amylose are examples of suitable fine powders.

The term liquid is used herein to broadly include, for example, mixtures, solutions, dispersions and emulsions, from low to very high viscosities including gels and pastes. The preferred viscosity may be up to 10,000 mPa.s, but it is more preferably from 100 to 1000 mPa.s, and most preferably from 300 to 500 mPa.s. The liquid may contain active ingredients suitable for various applications. Examples of such applications are agrochemicals, e.g. pesticides, herbicides, fungicides, insecticides; industrial chemicals, e.g. materials used in construction industries, materials used in photography, printing and textile industries; chemicals for treating water, e.g. swimming pools, water heating systems, sewage and drainage systems; health and beauty care products, e.g. pharmaceutical and cosmetic applications; domestic and consumer products, e.g. laundry cleaning and treatment, dish and hard surface cleaning, shampoo, bath additives. Particularly preferred liquids are suitable for use as liquid detergents in the cleaning of clothes, dishes, and other household surfaces.

According to the present invention a plurality of flexible liquid-filled pouches is contained in a random orientation with an outer container. By "random orientation" it is meant that the

pouches are piled in immediate proximity to one another, and are not prevented from touching each other by packaging material such as trays, blister packs or such means. It is a requirement of the present invention that at least two flexible pouches must be in mutual contact, and it is envisaged that in practice several flexible pouches will be contained within the outer container, and each flexible pouch will be in contact with one, two, three or more of its neighbouring pouches. There is no upper limit on the number of pouches that may be random packed together in this way, but about 100 pouches may be considered to be a reasonable practical upper limit. Preferably from 2 to 50 pouches may be packed together in this way, more preferably from 8 to 30 pouches, and most preferably from 10 to 20 pouches.

The outer container of the present invention may be any carton, box, tub or similar container. The outer container preferably comprises a closure, such as a lid, to provide some protection from changing atmospheric conditions, humidity etc., to the liquid-filled pouches inside. A lid may be of the tear open kind, but more preferably the lid is suitable for opening and reclosing the outer container. A recloseable lid permits the liquid-filled pouches to be removed one at a time, and permits the outer container to be reclosed between each use. A particularly preferred outer container is provided by a thermoforming or by an injection-molding process. The preferred tub may be provided with either a hinged lid or a completely removable, for example a snap-fitting lid. Suitable plastics for the container include polyethylene, polyethylene terephthalate, polypropylene, polystyrene as well as other plastics commonly used in the packaging field. Tubs of this kind are well-known for packaging foodstuffs, especially ice cream.

The problem with random packing of somewhat fragile flexible liquid-filled pouches in outer containers of the type described above, is that the pouches may be damaged when the outer container is subject to mechanical shock. Such shocks are likely to occur during the packing process and the distribution chain from manufacturer to retailer, as well as when the outer container reaches the hands of the ultimate consumer. Such shocks may cause the pouches to be ruptured. Herein the term "ruptured" encompasses torn, burst or split, or any other occurrence which has the consequence that the liquid product is free to be distributed around the inside of the outer container. In the event of this happening, the freed liquid product contaminates the surfaces of other pouches within the outer container and also contaminates the inside of the outer container. The result is unsightly, messy and inconvenient. In the worst case, if the liquid product contains toxic chemicals, the user is exposed to toxic hazards.

The present invention overcomes such problems by means for avoiding or minimizing rupture of the flexible liquid-filled pouches when the outer container is subject to shock. In a first

embodiment of the invention, the liquid-filled pouches, in random orientation, are tightly wrapped within a further wrapping material before the pouches are placed into the outer container. The further wrapping material could be, for example, a bag, film or net. In order to achieve the constraint of tightly wrapping, a preferred process with a film or bag is shrink-wrapping or stretch-wrapping; a preferred process with a bag is vacuum-packing; and a preferred process with a net is stretch-wrapping hereby the elastic properties of the net constrain the contents, in this case the liquid-filled pouches, within it. It is envisaged that the ultimate consumer will remove the further packing material before using the first liquid-filled pouch. A line of weakness such as a tear-strip or perforated line may facilitate the removal or opening of the further packing material. In such a case, the tightly wrapped pouches are much less likely to rupture during the packaging and distribution processes, although clearly they are not so protected after the further packaging material has been removed by the ultimate consumer. The liquid-filled pouches could be tightly-wrapped in the further wrapping material and sold in this form as refills for consumers who already have a suitable outer container.

In a second embodiment of the present invention, the means for avoiding or minimizing rupture comprises a cushioning material placed within the outer container. The cushioning material may be foam, e.g. a polymeric foam; or a cellulose-based paper or board. Packaging material commonly known as "bubble wrap" may also be used as the cushioning material. Particularly preferred cushioning materials are polyethylene foam or corrugated cardboard. Different cushioning materials may also be used together and in combination. Conveniently, the cushioning material may have dimensions substantially corresponding to the base of the outer container, and may be placed into the base of the outer container before the flexible, liquid-filled pouches are placed therein.

In practice both the first and second embodiments described above may be combined together in one package.

Preferred processes for forming the liquid-filled pouch include vertical-form-fill-sealing, often referred to as VFFS, and thermo-forming or vacuum-forming processes. The latter two processes are often combined as a vacuum-thermo-forming process, such processes being exemplified in US-A-3,218,776, issued on 23rd November 1965, and assigned to Cloud Machine Corporation; and in WO02/60758, published on 8th August 2002, and assigned to The Procter & Gamble Company, both incorporated herein by reference. The general state of the art of forming pouches is described in "Packaging of Pesticides and potentially Hazardous Chemicals for

Consumer Use", Edwards, David B., 1995, published by PIRA (ISBN 1 85802 102 2), incorporated herein by reference.

Pouches made by processes such as those described above are then transferred to a packing station where they may optionally be tightly enclosed in a further wrapping material, as suggested by the first embodiment of this invention, and/or packaged in the outer container with cushioning material as suggested by the second embodiment of this invention.

In order to ensure quality standards some imperfect pouches may be rejected. It is preferred that such reject pouches are reclaimed by passing the pouch first through a mixing device which breaks open the pouches, for example a mixing device with breaker bars. A Sibus "Power Separator" is suitable for this purpose. Within the "Power Separator" a shaft rotates at 200 to 2000 rpm. The shaft carries breaker bars and paddles which break the pouches by mechanical action. The released liquid settles inside the essentially cylindrical chamber and exits the bottom of the chamber through a mesh. The remaining pouch material is transported by the mechanical action of the rotating shaft, breaker bars and paddles to the outfeed end of the "Power Separator" where it is collected. Subsequently the reclaimed liquid can be reblended and reused, and the reclaimed pouch material can be further processed and recycled for reuse.

Examples

In a preferred embodiment of the present invention, the liquid is a liquid detergent for use in the cleaning of clothes, dishes, and other household surfaces. Specific examples of such liquid detergent compositions are given in US-A-4,929,380, issued on 29th May 1990, and assigned to Henkel KgaA and in US-A-4,973,416, issued on 27th November 1990, and assigned to The Procter & Gamble Company, both of which are incorporated by reference. Another specific example of a liquid detergent composition is given below in Table 1:

	% by weight
Linear alkyl benzene sulphonate	22%
Nonionic surfactant	18.7%
C_8-C_{10} amido propyl dimethyl amine	1.8%
Propane diol	15.7%
Monoethanolamine	11%
Citric acid	1.6%
Fatty acid	16.6%
Brightener	1.2%
Enzymes	1.0%
Perfume	1.2%
Polymers	3.2%
Phosphonate chelant	0.9%
Formic acid	1.1%
Water	To balance (~4%)

Table 1

The composition in Table 1 was made into flexible liquid-filled pouches using a horizontal vacuum-thermo-forming process disclosed in WO 02/60758. Each pouch contained about 50ml of liquid product at viscosity of 300 mPa.s (measured at 20°C and a shear rate of $21s^{-1}$). The film used was M8630®, supplied by Mono-Sol LLC, having a thickness of 76 micrometers.

Example 1: Outer containers in the form of plastic tubs with snap-fit lids, slightly tapered from top to bottom, having average inner dimensions of 160mm long x 65mm wide x 140mm high, were provided without any cushioning layers. 12 liquid-filled pouches were placed in a bag which was shrunk by vacuum around the pouches so that the pouches were tightly enclosed. Each outer container was then filled with one sleeve containing 12 pouches.

Example 2: Further outer containers of the same form and dimensions were provided with a cushioning layer consisting of five layers of polyethylene foam each of 2mm thickness, and density of 20 kg/m^3 which was cut to fit snugly inside the base of each tub. Each outer container was filled, in random orientation, with 12 pouches.

Comparative Example A: Outer containers without added cushioning were filled, in random orientation, with 12 pouches, but without any further packaging material to protect the pouches. Packaged products of Example A are illustrated in the Applicant's British Design Registration No. 2,106,584, filed on 30th November 2001.

Results: The above packages containing pouches were subject to drop tests wherein the containers were dropped repeatedly from a height of 1 meter onto a solid surface to simulate mechanical shocks, the test being replicated with a sufficient number of packages for statistical accuracy. After 5 drops the sleeved pouches within outer containers (Example 1) had failed only 20% of the time; after 5 drops the cushioned outer containers (Example 2) had failed only 30% of the time; whereas the comparative packages, with no protection, (Example A) failed in more than 80% of the tests. (N.B. A "failure" is considered to have occurred if one or more of the pouches has ruptured).